

Amendments to the Specification:

Please replace the paragraph beginning at page 2, line 6 as with the following amended paragraph:

--Referring to FIG. 1, a network processing system 10 is shown operating as a data packet cross-bar device. The network processing system 10 receives packets (through I/O buses 14a-14n from external devices not shown), stores the packets temporarily, interprets header (address) information contained in each packet, and transmits each packet to a destination indicated by its header when an appropriate I/O bus 14a-14n is available. System 10 may include connections to thousands of I/O ~~buses and~~ buses and may need to simultaneously store and track tens of thousands of data packets of various sizes before each packet is transmitted out of system 10. The storage and the input and output of data packets (packets) to and from I/O buses 14a-14n is controlled by several processors 12a-12n.—

Please replace the paragraph beginning at page 2, line 20 with the following amended paragraph:

--System 10 includes a first memory 18, to store the received data packets from a set of data buffers 18a-18n. The data buffers 18a-18n are not necessarily contiguously stored in the first memory 18. Each data buffer 18a-18n is indexed by a buffer descriptor address (BDA) that indicates the location and size of the buffer. ~~As each~~ As a packet is received from one of the I/O buses 14a-14n and stored by one of the processors ~~12a-12n~~ 12a-12n in one of the buffers 18a-18n of the first memory 18, the processor, e.g., processor 12a identifies one of a set of I/O ~~ports~~ buffers 16a-16n for transmitting the packet from the data buffer ~~18a-18n out~~ 18a-18n out of

system 10. Each of the I/O ~~ports~~ buffers 16a-16n is associated with one of the I/O buses 14a-14n). --

Please replace the paragraph beginning at page 3, line 9 with the following amended paragraph:

--Often, the I/O port chosen for transmitting a packet stored in a an I/O buffer is busy receiving or sending packets for other I/O buffers. In this case, the system 10 includes a second memory 20 for storing the packet. The second memory 20 stores a queue array 24. The queue array 24 has buffer descriptor addresses (BDAs) for packets that are stored in data buffers 18a-18n of the first memory 18 and are waiting for an assigned I/O ~~port~~ buffer 16a-16n to become available.--

Please replace the paragraph beginning at page 3, line 17 with the following amended paragraph:

--Each data packet received may vary in size. Therefore, the size of each data buffer 18a-18n may also vary in size. Furthermore, each data buffer 18a-18n may be logically partitioned by a processor 12a-12n into one or more "cells". Each cell partition represents a maximum size of a data packet that may be transmitted by an I/O buffer 16a-16n. For example, ~~in FIG. 1,~~ data buffer 18a is partitioned into two cells, data buffer 18b includes ~~only~~ one cell, and data buffer 18c includes three cells.--

Please replace the paragraph beginning at page 4, line 3 with the following amended paragraph:

--System 10 also includes a queue manager ~~logic~~ 22 connected to processors 12a-12n and second memory 20. Queue manager 22 includes a the queue array 24 that includes several queue entries, with each queue entry corresponding to an I/O buffer, 16a-16n. Each queue entry in queue array 24 stores multiple BDAs, where one BDA links to another BDA in the same queue. Queue array 24 is stored in second memory 20. Alternatively or in addition thereto the queue manager 22 may include a cache containing a sub-set of the contents of queue array 24.—

Please replace the paragraph beginning at page 4, line 12 with the following amended paragraph:

--Each BDA includes both an address of the stored data buffer in first memory 18, and a “cell count” that indicates the number of cells contained in a data buffer, 18a-18n. The BDA is, for example, 32 bits long, with the lower 24 bits being used for an address of the buffer descriptor and the upper 7 bits being used to indicate the cell count of the data buffer.--

Please replace the paragraph beginning at page 4, line 19 with the following amended paragraph:

--Processors 12a-12n store and retrieve data buffers from queue array 24 by sending “En-queue” and “De-queue” commands to queue manager 22. Each En-queue and De-queue command includes a queue entry number included in queue array 24. Queue manager 22 responds to a De-queue command by returning a BDA stored at ~~the~~ a “head” of the queue 24, i.e., ~~the~~ a top entry of the queue entry specified to the requesting processor. Queue manager 22 also uses the cell count included in the head BDA being returned to determine whether all of the cells included in the corresponding data packet have been sent. If the cell count is greater than

zero, then the queue manager 22 leaves the head BDA in the head location of the queue 24.

When the cell count for a De-queued BDA has reached zero another linked BDA is moved to the head of the queue 24, as will be explained.—

Please replace the paragraph beginning at page 5, line 10 with the following amended paragraph:

--Referring to FIGS. 2A and 2B, a first queue entry, "Qa," ~~is shown~~ of an exemplary queue array Qa-Qn is shown. Each queue entry included in queue array Qa-Qn includes a three-block queue descriptor 51a-51n, and may also include additional BDAs that are linked to the same queue entry. Each queue descriptor 51a-51n includes a first block 52a-52n that contains the head BDA for the queue entry, a second block 54a-54n that contains the "tail" address for the queue entry and a third block 56a-56n that contains a "queue count" for the queue entry.--

Please replace the paragraph beginning at page 5, line 20 with the following amended paragraph:

--As an example of a queue entry that includes both a head BDA and a linked BDA, queue "Qa" is shown ~~in FIG. 2A~~. In this example, head block 52a has the BDA that will be returned in response to a first De-queue command specifying entry Qa. Head BDA 52a links to a second BDA stored at address "a:" 57a. "Tail" block 54a contains the address "b:" of the last linked address of entry Qa. The address contained in Tail block 54a points to the storage location where another BDA may be En-Queued (and linked to) queue entry Qa. Third block 56a contains ~~the~~ a current value of Queue Count that indicates ~~the~~ a number of linked buffer descriptors included in the queue entry Qa Q. In this example, Queue Count 56a equals two,

indicating a first BDA in the “head” location 52a and a second linked BDA in block 57a. It is noted that the BDA contained in the head block 52a-52n, of each queue descriptor 51a-51n, contains the BDA and Cell Count of the second linked BDA on the queue entry Qa Q, 57a-57n, unless the Q queue entry Qa includes only a single BDA.—

Please replace the paragraph beginning at page 6, line 20 with the following amended paragraph:

--Referring to FIG. 3A, a example of the sub-process 100 receives (102) an En-queue command that specifies a Q queue entry in the queue array Qa-Qn and a BDA for a new data buffer. Sub-process 100 stores (104) the new BDA in the location indicated by the tail address, up-dates (106) the tail address to point to the new BDA and increments (108) the queue count by one (block 56a-56n). Sub-process 100 may be repeated to store and link, additional data buffers onto the “tail” of a queue entry, that is, En-queueing an additional BDA onto the linked address location at the tail of a queue entry, etc.--

Please replace the paragraph beginning at page 7, line 7 with the following amended paragraph:

--Referring to FIG. 3B, an example of sub-process 120 depicts a process of De-queueing data buffers, i.e., BDAs, from a queue entry included in queue array Qa-Qn (~~see FIG. 2B~~). Sub-process 120 receives (122) a De-queue command that specifies a queue entry included in queue array Qa-Qn. Sub-process 120 returns (124) the BDA from the head of the queue descriptor for the specified queue entry to the requesting processor. ~~Process~~ Sub-Process 120 determines (126) whether the cell count from the head BDA is greater than zero. If the cell

count is greater than zero, ~~process~~ sub-process 120 decrements (128) the cell count included in the head BDA and exits (140). If the cell count is not greater than zero, process 120 determines (129) if the Queue Count is greater than or equal to one. If the Queue Count is not greater than or equal to one (indicating the queue entry is empty) ~~process~~ sub-process 120 exits (140). If the Queue Count is determined (129) greater than or equal to one (indicating the queue entry contains another linked BDA) ~~process~~ sub-process 120 sets (130) the next linked BDA to be the head buffer descriptor decrements (132) the queue count and exits (140). Sub-process 120 may be repeated to De-queue the head BDA and subsequent linked BDAs stored in a queue entry in queue array 24.—

Please replace the paragraph beginning at page 8, line 5 with the following amended paragraph:

--Performing process 80 on a system, such as system 10, enables the system to keep a multiple-cell data buffer that is being transmitted at the head of a queue entry. This is an advantage when a relatively large number of I/O ~~ports~~ buffers are being served concurrently, with one or more I/O ~~ports~~ buffers requiring cell-at-a-time data transmission.—

Please replace the paragraph beginning at page 8, line 11 with the following amended paragraph:

--Referring to FIG. 2C, a logical representation of the sequence of data packets that are transmitted by a system performing process 80 is shown. The data buffers, 18a-18n, and cell numbers of FIG. 2C correspond to the same numbers shown in ~~Figs.~~ FIGs. 1 and 2B. As shown in FIG. 2C, a system performing process 80 causes the two cells of data buffer 18a to be

transmitted before the transmission of the first cell of data buffer 18b is begun. Likewise, data buffer 18b completes transmission before the first cell of data buffer 18c begins transmission, and so forth. --

Please replace the paragraph beginning at page 8, line 21 with the following amended paragraph:

~~--FIG. 1 shows a computer system 10 on which process 80 may be implemented.~~ Process 80 is not limited to use with the hardware and software of FIG. 1. It may find applicability in any computing or processing environment. Process 80 may be implemented in hardware, software, or a combination of the two. Process 80 may be implemented in computer programs executing on programmable computers or other machines that each include a processor, a storage medium readable by the processor (including volatile and non-volatile memory and/or storage components), at least one input device, and one or more output devices. Program code may be applied to data entered using an input device (e.g., a mouse or keyboard) to perform process 80 and to generate output information.--